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Appraisal of Building Defects Due To Poor Workmanship In Public Building Projects In Minna, Nigeria

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Abstract: - The rate of construction project accomplishment is weak because of the rapid increasing rate of major defects in building as a result of poor quality materials and workmanship which has been identified as the major cause of defects in Nigerian construction projects. This necessitated the examination of problem of poor workmanship as a major cause of building defects. This was achieved by examining the factors leading to poor workmanship quality in public building projects. Data were sourced on public building projects whose contracts have been executed from practitioners in the construction industry in Minna, Nigeria through the use of questionnaires. The analysis of data was carried out using mean item score and correlation analysis. Eight factors were identified as factors which contribute to poor quality workmanship out of which limited cost or poor funding of public building projects was the major factor that causes poor workmanship quality, while proper construction management and strict supervision were found to be the most effective solutions for solving the problem of poor quality workmanship. Recommendations from the study included that proper construction management and strict supervision are required during project execution.

Key Words: *- Building defect, Poor workmanship, Public buildings*

I. INTRODUCTION

1.1 Background of the Study

According to Kheni et. al[1] (2008) the construction industry plays a significant role in the economy of developing countries. In the same vein, Ibironke[2] (2003) and Shittu & Shehu[3] (2010) reported that the construction industry is very important in the economic development of any nation, especially in an expanding economy like Nigeria. Okeola[4] (2009) added that at least 50% of the investment in various development plans is primarily in construction and the industry is the next employer of labour after agriculture in underdeveloped countries. The construction industry is still seen as one of the most dangerous industries due to the number of accidents recorded yearly (Jaselskis & Suazo[5], 1994). Lingard & Rowlinson[6] (1994) and Spillane et al[7]. (2011) reported that the construction industry in most developing and developed countries have been adjudged to be performing very badly in the area of safety by international standards. Omran et al.[8] (2010) added that the construction industry is characterised as one with a poor safety culture globally. A very serious safety problem facing Nigeria is the problem of defect in building as a result of poor quality materials and workmanship which leads to fatal site accidents due to building collapse.

Poor quality in construction projects is a common phenomenon in the world. Many disputes happened among clients, house owners and parties involved in construction (especially contractors) on construction defects cases. According to Baiden & Tuuli[9] (2004), *"defects and variations in construction products from standards is persistently a problem of concern in the construction industry in Ghana"*. Defects in construction project could also be seen as incompliance or lack of conformity with contract agreement which include; working drawing, specification, quality of workmanship, and any-other condition not expressly stated such as "durability, aesthetic, performance or design". The problem of defective construction witnessed in the construction sector was tackled by the introduction of "Quality Assurance (QA) techniques" which was initiated by other industries, however, the technique is still being improved on to be suitable in the construction companies.

Kazaz & Birgonul[10] (2005) stated that the satisfaction of quality level in the construction projects has not been achieved and is a serious problem in Turkey. Abdul Razak *et al*.[11] (2010) stated that quality of the certain construction projects in Malaysia does not always meet satisfaction. Nevertheless, Wai Kiong & Sui Pheng (2005) found out that the majority of human errors arise as a result of *"forgetfulness and carelessness,"* and about 30% were due to inadequate knowledge while the least error arises from the willingness of the

contractor. Wai-Kiong & Sui Pheng[12] (2005) further claimed that the absence of incentive is the key factor affecting workmanship quality and also that the incidence of risk result to the occurrence of defects. In general, defects are considered to arise as a result of "lack of knowledge, lack of information or lack of motivation" while "Carelessness" was claimed to be the most significant cause.

Defects in building can therefore arise from either or a combination of the occurrence of following situation; error in design by the Architect, flaws from the manufacturer, defects in materials, wrong use or inappropriate installation of equipments, and inconformity to specification by the contractor, among others. General forms of defects in construction includes either or a combination of the following; defects in structure giving rise to cracks or collapse; defects or faults in electrical and plumbing installations; inadequacy of drains for proper disposal; insufficient provision for ventilation; poor cooling and/or heating system; poor sound insulation system, and insufficient fire prevention or protection mechanism. In addition, defects in building may also be as a result of the following; fungus, termite, or vermin infection, fungus, wood rot, mould, and dry rot. Damages as a result of earth settlement or land movement may also result to defect to building. Ascertainment of defects in building can only be done by an expert, such as architect or engineer, who by training and experience will be able to confirm the causes of the problem, either resulting from poor design, low quality of material or poor workmanship.

According to Abdul Rahman *et al*.[13] (1996), workmanship was classified as one of the most frequent non-conformance on construction site and therefore through literatures, eight variables that related to the causes of poor quality of workmanship in construction projects had been found out. These are:

i. Poor project management
ii. Complicated role of subcontractor
iii. Lack of experience and competency of labours
iv. Language barrier to communication and lack of communication
v. Unsuitable construction equipments
vi. Poor weather condition
vii. Limited time
viii. Limited cost

1.2 Statement of Problem

The rate of construction project accomplishment is weak because of the rapid increasing rate of major defects in building as a result of poor quality materials and workmanship which has been identified as the major cause of defects in construction projects (Abdulrazak et al[11], 2010). In the same vein, Abdul Rahman et al.[14] (2006) stated that the causes of defects in construction are varied and at times cannot be easily established due to their nature which could be independent or combined occurrence (i.e. interrelated persons or groups). It is against this backdrop that this research was carried out to examine the problem of poor workmanship as a cause of building defect, with the intent to proffer suitable solutions to the problem.

1.3 Research Questions:

In order to study the problem identified, the following questions have been stated for the study:

i. What are the common defects in building construction?
ii. What are the factors leading to poor quality workmanship in public buildings?
iii. What are the solutions to these problems of poor quality workmanship?
iv. What is the relationship between preventive defect measures identified and the causes of defect due to poor quality workmanship?

1.4 Aim and Objectives:

The aim of this research is to examine the problem of poor workmanship quality as a cause of building defect with a view of proffering solutions to minimize these problems. The following objectives were set out in order to achieve the aim:

i. To examine the common defects in building construction.
ii. To examine the factors leading to poor workmanship quality in public building projects.
iii. To identify possible measures to prevent/minimize these problems.
iv. To determine the relationship between preventive defect measures identified and the causes of defect due to poor quality workmanship.

1.5 Need for the Study:

Most public buildings in Minna, Niger State are faced with problems of defects such as "cracking, staining/discolouration, sealant failures, efflorescence, rising dampness/water penetration, corrosion, buckling/deflection, tile/plaster delaminating" which have resulted due to poor building materials and

workmanship. According to Dimuna[15] (2010), the rising incidents of building collapse are due to substandard building materials and incompetent professionals in construction activities. These problems have contributed setbacks in the construction industry in Minna environs. Most of the authors only discovered that the major problem of defects is due to poor workmanship quality but have not carried out an in-depth study of this problem. Hence it becomes necessary to carry out a research that would examine problem of poor quality workmanship critically in order to help in contributing for providing solutions to the problem faced by workmanship in public buildings using Minna, Niger State of Nigeria as a case study so as to improve the quality of the public building construction project in the environ.

II. METHODOLOGY

This research work considered causes of building defect in public buildings within Minna, Niger States in some ministries, schools, housing estates, hospitals and other public buildings for the analysis. The study involved wide ranging review of literature related to the theme of the study. The source of data collection for this research was through administration of questionnaire in the study area. Due to the time allocation for this research work, other areas in Niger State were not considered since the State is large. Sampling size of one hundred (100) people was targeted based on the central limit theorem which states that as the size of sample approaches the distribution of that sample assumes a normal or symmetrical distribution upon which generalisation of findings is possible. Random sampling technique was adopted for selecting respondent from the population comprising of professionals in the built environment both in the consulting and contracting organisation as well as tenants.

Tables, pie chart and bar graphs were employed for data presentations. The analysis of the collected data was carried out using the following descriptive and analytical scientific methods; mean item score and correlation analysis. Mean Item score was used to rank, in order of importance, causes of poor workmanship. The correlation analysis was used to determine the relationship between preventive defect measures identified and causes of defects due to poor workmanship quality. Allocation of questionnaires and rate of return are presented in TABLE 1 below:

Table 1: Respondent based on Profession

Job Title	Questionnaire	Return Frequency	Return Percentage
Builder	20	20	20%
Engineer	20	20	20%
Architect	20	20	20%
Quantity Surveyor	20	20	20%
Estate Surveyor	20	20	20%
Total	100	100	100%

Source: Field Survey, 2013

TABLE 1 gives information on how distributed questionnaires were being attended to functionalise the appraisal of building defect due to poor workmanship in public building in Minna, Niger State. Hundred questionnaires were distributed and thus representing 100 percent of returned questionnaires.

III. DATA ANALYSIS AND DISCUSSION OF RESULTS

3.1 Results of Common Building Defects in Minna

The various standards of the quality of buildings provided in Minna as opined by the respondents are presented in Fig. 1 below:

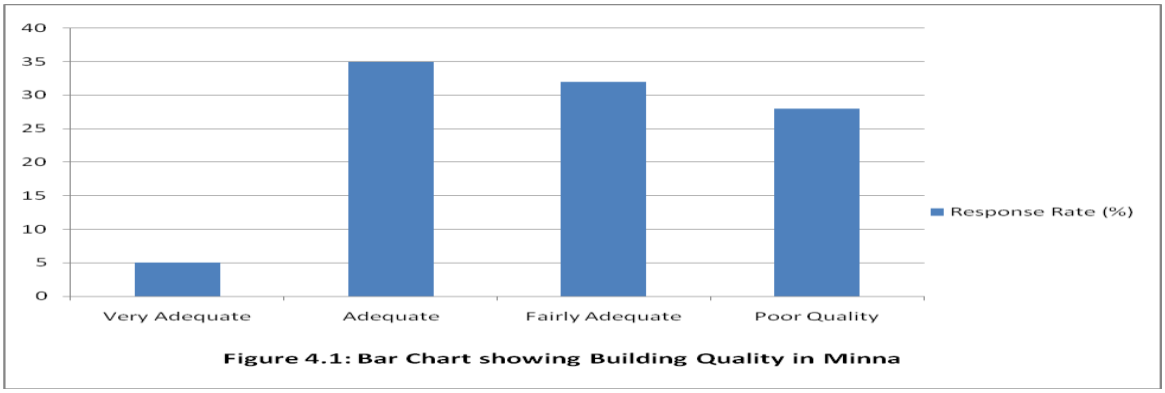

Figure 4.1: Bar Chart showing Building Quality in Minna

Figure 1: Bar Chart showing Building Quality in Minna

The frequencies of occurrence of the identified common defects in buildings as opined by the respondents are presented in Fig. 2 below:

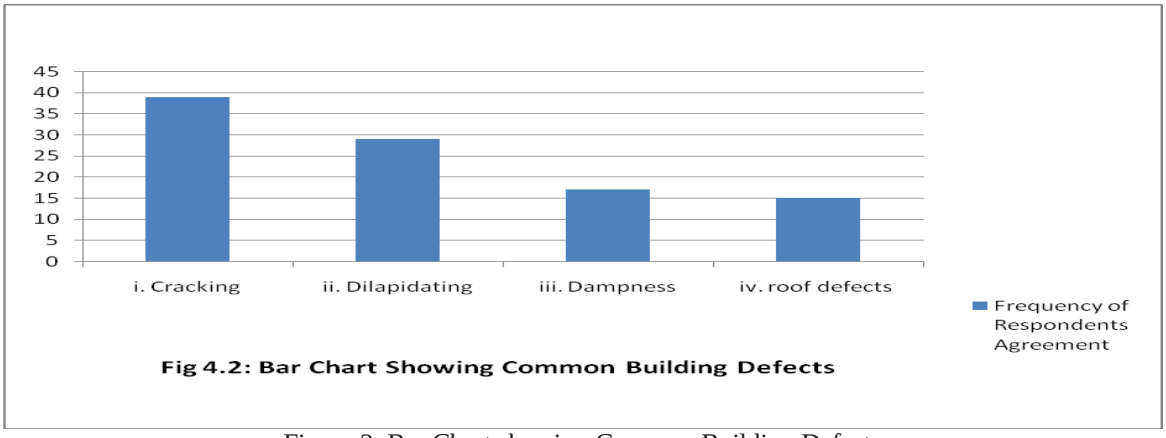

Figure 2: Bar Chart showing Common Building Defects

TABLE 2 presents the common defects identified in building construction in accordance to respondents' opinion in the study.

Table 2: The Common Defects in Building Construction

Questions		Agree	Ranking
i.	Cracking	39	1
i.	Dilapidating	29	2
i.	Dampness	17	3
v.	roof defects	15	4
Total		100	

Source: Field Study, 2013

In testing for Research Question I for quality and common building defects, most public buildings in Minna were ranked to have quality within range: very adequate, 5%; adequate, 35%; fairly adequate, 32%; and poor quality of building rated 28%. This implies that most public buildings in Minna are fairly constructed and executed based on quality at 35% majority opinion as in Fig. 1. The defect in most public buildings have highest ranking of 39% for cracking, 29% dilapidating, 17% dampness while the roof defects was just 15% as in Fig. 2.

For normal distribution standardisation, mean value was obtained for the research question. TABLE 2 shows that cracking was ranked first (most important), dilapidating ranked second, dampness ranked third and roof defects ranked fourth (least important).

3.2 Results of Factors Leading to Poor Workmanship Quality in Minna

The factors identified to be responsible for poor quality workmanship in public buildings in the study are presented and ranked in order of importance in TABLE 3.

Table 3: Ranking of Factors that lead to Poor Quality Workmanship

Questions		Mean	Rank
i.	Poor project management	2.4	7
ii.	Complicated role of subcontractor	2.05	8
iii.	Lack of experience and competency of labourers	3.07	3
iv.	Language barrier to communication and lack of communication	2.87	4
v.	Unsuitable construction equipment	3.68	2
vi.	Poor weather condition	2.82	5
vii.	Limited time	2.75	6
viii.	Limited cost	4.25	1

Source: Field Study, 2013

For Research Question II "factor leading to poor quality workmanship in public building"; TABLE 3 shows that limited cost or fund was the major factor and ranked "1". Unsuitable construction equipment was the second on the list. Third ranking was allocated to lack of experience and competency of labourer. Language barrier to communication and lack of communication was ranked fourth (4); poor weather condition was ranked fifth (5); limited time was ranked sixth (6); poor project management was ranked seventh (7), while complicated role of subcontractors was the least to be considered with a ranking of "8". On the average, the factors in research question II were fairly important problems facing poor workmanship with a score of 3 out of 5 points.

3.3 Results of the Ranking of Identified Solutions to Poor Workmanship Quality in Minna

The solutions proffered to the problems of poor quality workmanship in public buildings in the study by the respondents' opinions are presented in TABLE 4.

Table 4: Ranking of Solutions to the Problems of Poor Quality Workmanship

Questions	Mean	Rank
Strict Supervision	3.50	6
Training and Education	4.60	2
Proper Communication among parties involved	4.13	5
Proper Construction Management	4.65	1
Proper manpower Management	4.40	4
Proper Design	4.44	3
Total	4.286	

Source: Field Study, 2013

TABLE 4 shows ranking of research question III "solution to the problems of poor quality workmanship in public buildings". In solving these problems, proper construction management was ranked firs (most important/effective solution), the most necessary. Training and education ranked second; proper design were ranked third; proper manpower management ranked fourth, proper communication among parties involved ranked fifth and strict supervision was ranked sixth (least for solving the problem). It means on average using these solutions for solving the problem on research question II would be important which with a score of 4 out of 5 points.

3.4 Results of the Relationship between Poor Workmanship Quality and Recommended Solutions

TABLE 5 shows significant difference or relationship that could be obtained between factors that contribute to workmanship and solution.

Table 5: Difference between Contributing Factor and Solution

Questions	Strict supervision	Training and education	Proper communication among parties involve	Proper construction management	Proper manpower management	Proper design
Poor project Management	1.09	2.19	1.72	2.24	1.99	2.03
Complicated role of subcontractor	1.45	2.55	2.08	2.60	2.35	2.39
Lack of Experience and competency	0.43	1.53	1.06	1.53	1.33	1.37

of labours						
Language barrier to communication and lack of communication	0.63	1.73	1.26	1.78	1.53	1.57
Unsuitable construction equipment	-0.18	0.92	0.45	0.97	0.72	0.76
Poor weather Condition	0.68	1.78	1.31	1.83	1.58	1.62
Limited time	0.75	1.85	1.38	1.9	1.65	1.69
Limited cost	-0.75	0.35	-0.12	0.4	0.15	0.19

Source: Field Study, 2013

A measurement used to express the degree of association between x and y is the Correlation coefficient (R). In Table 6 the contributing factor of TABLE 5 were correlated towards each other as obtained in the study.

Table 6: Squared of Difference between contributing factor and solution

Questions	**Strict supervision**	**Training and education**	**Proper communication among parties involve**	**Proper construction management**	**Proper manpower management**	**Proper design**
Poor project Management	1.1881	4.7961	2.9584	5.0176	3.9601	4.1209
Complicated role of subcontractor	2.1025	6.5025	4.3264	6.76	5.5225	5.7121
Lack of Experience and competency of labours	0.1849	2.3409	1.1236	2.4964	1.7689	1.8769
Language barrier to communication and lack of communication	0.3969	2.9929	1.5876	3.1684	2.3409	2.4649
Unsuitable construction equipment	0.0324	0.8464	0.2025	0.9409	0.5184	0.5776
Poor weather condition	0.4624	3.1684	1.7161	3.3489	2.4964	2.6244
Limited time	0.5625	3.4225	1.9044	3.61	2.7225	2.8561
Limited cost	0.5625	0.1225	0.0144	0.16	0.0225	0.0361
Total	5.4922	24.192	13.833	25.502	19.352	20.269
Correlation	0.935	0.712	0.835	0.696	0.770	0.7587

In this section, the relationship between poor workmanship quality and solution recommended has been carried out as presented in TABLES 5 and 6 and this answered the research question IV. From Table 4.6, it was revealed that strict supervision is the most and highly required measure for solving the problem and with correlation coefficient of 0.935. Proper communication among involved parties has 0.835 correlations. Proper manpower management has 0.77, while proper design has 0.7587 correlations. Training and education has 0.712 correlations while proper construction management has 0.696 correlations. The solutions provided for the problems are usable and suitable due to high average correlation condition of 0.994 for solving the problem.

IV. CONCLUSIONS

Eight factors were identified to be responsible for poor workmanship quality and proper measures for solving the problem were equally identified. These factors are poor management, complicated role of

subcontractor, lack of experience and competency of labours, language barrier to communication and lack of communication, unsuitable construction equipments, poor weather condition, limited time and cost.
From the above it was concluded that:

i. Proper communication is a necessary tool in building construction industry to provide communication between supervisors and construction labours, proper communication and teamwork are also necessary between contractors and subcontractors.
ii. Limited cost or fund for the public building projects was the major factor that causes poor workmanship in Minna.
iii. All these factors identified are fairly important to be the only problem facing poor workmanship in Minna.
iv. Identified solutions to the problems are important based on the study with score of 4 out of 5 points and these are strict supervision, training and education, proper communication among parties involved, construction management and manpower management and quality with strong and positive correlation (correlation coefficient of 0.994).
v. Out of these solutions, strict supervision is highly required for solving the problem of poor quality workmanship in Minna.

V. RECOMMENDATIONS

i. To improve the quality of public building in Minna, appropriate funding of project must be provided.
ii. Proper construction management is required during execution of the project
iii. Strict supervision of building projects must be provided
iv. To improve the productivity of building construction workers; building training and education would be necessary.

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APPENDICES

APPENDIX A: Covering Letter

Department Of Quantity Surveying Federal University Of Technology, Minna Niger State.

Quantity Survey

Dear Sir/Ma

This questionnaire is part of an academic research which is to be used to develop an article to be presented in an international conference. It is designed to appraise the building defects due to poor workmanship in public buildings in Minna, Niger State, Nigeria.

While appreciating your busy schedule, your participation in the survey is crucial to the success of this research. The information you provide will be kept with utmost-confidentiality and shall be used strictly for academic purposes.

Yours sincerely

Researchers.

APPENDIX B: Questionnaire

Questionaire Survey On

Appraisal Of Building Defects Due To Poor Workmanshiip In Public Buildings In Minna, Niger State:

SECTION A: General Information and Bio-data of respondents

Please choose from among the options supplied for each of the following and place a tick () in front of any of the alphabet letters that express your choice.

RESPONDENTS' INFORMATION MANAGERS, PROFESSIONALS SUPERVISORY STAFF

Name of Respondents (Optional) ……

1. Location……...
2. Age

(a) Less than 30yrs ☐ (b) 30yrs – 40yrs ☐

(b) (c) 40yrs – 50yrs ☐ (d) More than 50yrs ☐

3. Sex

(a) Male

(b) Female

4. What is your professional designation

(a) Builder (b) Engineer (c) Architect (d) Quantity Surveyor (e) Estate Surveyor]

5. Total length of services

(a) Less than 5yrs (b) 6yrs – 10yrs (c) 11yrs – 20yrs (d) More than 20yrs

6. Grade level

(a) Junior staff (GL 1 – 6) (b) Middle level (GL 7 – 11) (c) Senior staff (GL 12 – 15)

7. What kind of building do you occupy?

(a) Bungalow (b) Duplex (c) Storey building (d) Skyscraper (e) Other

8. How will you describe the condition of your building?

(a) Grossly adequate (b) Fairly Adequate (c) Adequate (d) Very Adequate

9. What's condition of your wall?

(a) Sound/intact (b) Cracking (c) Dilapidating (d) Dilapidated

10. What's the condition of your roof?

(a) Sound/intact (b) Leaking (c) Sagging (d) Dilapidating

11. Is there a complete conceptual; plan for housing development in Minna?

(a) Yes (b) No

SECTION B: RESPONSE FROM THE RESPONDENTS

This questionnaire is prepared to be distributed to correspondences in construction industry and residents at the case study area. An interview session will also be conducted to contractors and consultants in order to obtain their opinions and experiences to some related study. In the questionnaires, some scales are provided in order to get the highest rank answers from the respondents. The descriptions of the scales are as follows:

1. Very Least Important
2. Least Important
3. Fairly Important
4. Important
5. Highly Important

Please kindly express the level of your disagreement with each statement by placing a tick () appropriate box from number 1 to 5 using scale provided in each dimension below.
1. Very Least Important. 2= Least Important. 3= Fairly Important. 4= Important. 5 = Highly Important.

	QUESTIONS					
1	Poor project management					
2	Complicated role of subcontractor					
3	Lack of experience and competency of labour					
4	Language barrier to communication and lack of communication					
5	Unsuitable construction equipment's					
6	Poor weather condition					
7	Limited time					
8	Limited cost					

Please kindly express the level of your disagreement with each statement by placing a tick () in the appropriate box from number 1 to 5 using the scale provided in each dimension below.
1. Very Least Important. 2= Least Important. 3= Fairly Important. 4= Important. 5= Highly Important

1	Strict supervision					
2	Training and education					
3	Proper communication among parties involved					
4	Proper construction management					
5	Proper manpower management					
6	Proper design					